Chapter 5
TESTING AND EVALUATING OUTPUT: ALTERNATIVE NETWORKS

As we have noted before, when relationships between ***current*** travel patterns and land use can be mathematically defined or modeled, then that mathematical model can be used to generate ***future*** travel patterns based on projections of future land use.

We had assembled our demographic data, projected it to 2010 and 2025 and assigned it to specific traffic zones as future land use. We had computerized our existing road network, and calibrated the traffic forecasting model to within 2% of actual base year traffic counts. Our next step was to create a series of alternative road networks, use the calibrated model to test and evaluate their efficiency, and then choose among them.

The first road network we needed to evaluate, of course, was the current one, the ***1999 Calibrated Network***. That would then show us the extent of our current problems, and serve as a benchmark against which we could measure possible solutions.

- To see what would happen to traffic patterns if we continued to grow but made no improvements at all to our roads, we created two worst-case, "No-Build" scenarios, one each for 2010 and 2025.

- To test the net effect of new projects already in the pipeline, we created an "Existing Plus Committed" (E plus C) Network for 2010.

- To see how we could alleviate traffic problems that would still need to be solved after 2010 E plus C, we then created a series of "Alternative Networks", which then evolved into this updated **2025 Transportation Plan**.

EVALUATION CRITERIA

We needed to find appropriate measures or criteria to compare proposed transportation networks to each other. When the model is applied to data in any existing or proposed network, the resulting output comes in the form of traffic volumes along each link. But volume alone -- sheer numbers of vehicles -- is not a useful measure of efficiency: The effect of 20,000 vehicles/day on four-laned, 65 mph I-65 is simply not comparable to the effect of 20,000 vehicles/day on Main Street with its two lanes, parking maneuvers and frequent traffic signals.

As motorists or passengers, and as planners, we are really not concerned with how ***many*** cars are on the road. What worries us is how ***congested*** the road is. Congestion delays us, causes accidents, slows down delivery and increases the cost of goods and services, wastes fuel and adds to pollution. The prime purpose of transportation planning is to minimize congestion. And thus the best measure of efficiency for any alternative transportation network is how well it reduces congestion.

The planners' measure of congestion is called "Level of Service" (LOS), which can also be determined mathematically. The LOS for any link in the network is a function of traffic volume and specific characteristics along that link: number of lanes, travel speed, turning movements, parking lanes,

traffic signals, etc. There are six Levels of Service, measured at peak hour, ranging from "A" to "F":

- At **LOS A**, traffic flows freely, there are no restrictions on vehicle maneuverability, and drivers feel physically and psychologically comfortable. **LOS B** is virtually as free.
- **LOS C** describes a stable rather than free flow of traffic. Cars move in discernible groups, called platoons. Drivers have less freedom to choose speed, must be more vigilant when changing lanes. This results in mildly increased driver tension.
- At **LOS D**, traffic flow is unstable. Drivers notice decreased physical and psychological comfort levels, brought on by slowed but tolerable driving speed, decreased maneuverability and an increasing accident potential.
- At **LOS E**, the road is operating at or near capacity. Drivers feel uncomfortable, with little or no control over speed or lane choice. Traffic alternately speeds up and slows down, and accident potential becomes high.
- **LOS F** represents a breakdown in the flow of vehicles, a forced flow. Stop-and-go traffic produces high levels of physical and psychological discomfort in drivers. Tempers are frequently lost.

As drivers, we would like all our roads to operate at free flowing LOS A or B. As taxpayers and planners we realize this to be impractical. We cannot afford to build largely empty roads. Instead, officials strive to plan, design and build roads that will operate at LOS C standards during peak hour usage.

And that is how we evaluate and compare transportation network alternatives. The object is to eliminate or at least minimize the difficult miles of LOS D, E, and F in the network, in favor of LOS C. Alternatives that

transform segments of LOS D, E, and F solely into LOS A or B would likely be very effective but prohibitively expensive; those that fail to achieve LOS C are less expensive but insufficiently effective. A balance must be struck.

Clearly there are other measures that must be applied when comparing alternate solutions to transportation network problems. Cost, even independent of LOS, is one. For instance, it may not be fiscally feasible to buy the right-of-way needed to widen a narrow road already lined with homes. We must consider social factors as well: An effective solution may well be useless if for instance a new road must be built that would split a neighborhood in half, or that would force many families to relocate. And sometimes heavy traffic and pedestrian flows make an unsafe mix. Thus the best physical solutions often must be tempered with fiscal restraint and social responsibility.

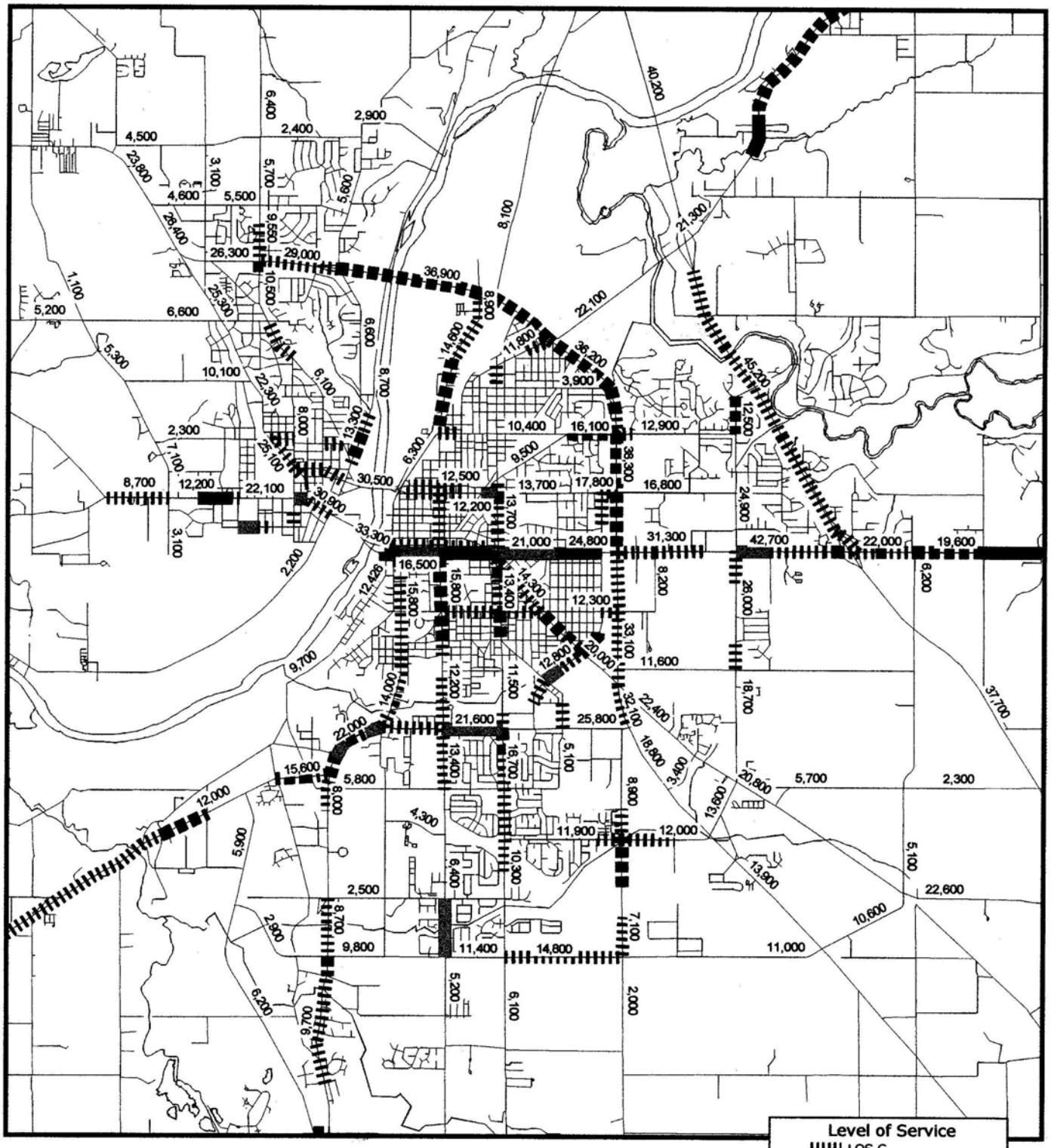
The remainder of this chapter is devoted to evaluating the alternate transportation systems that have been created for the ***2025 Transportation Plan Update***. Each network will be evaluated by Level of Service (LOS) in miles. Because LOS C is where traffic actually begins to become unstable, only LOS C through F will be calculated and shown by network and functional classification in miles.

THE CURRENT NETWORK AND THE NO-BUILD ALTERNATIVES

Many of us have commented on how congested our streets are. **Figure 3** shows us in graphic form what we experience behind the wheel: stretches of South Street, State Street, SR 26, SR 25, and SR43 are already operating at LOS F. Other parts of South Street, State Street, SR 25, SR 43, along with

Figure 3

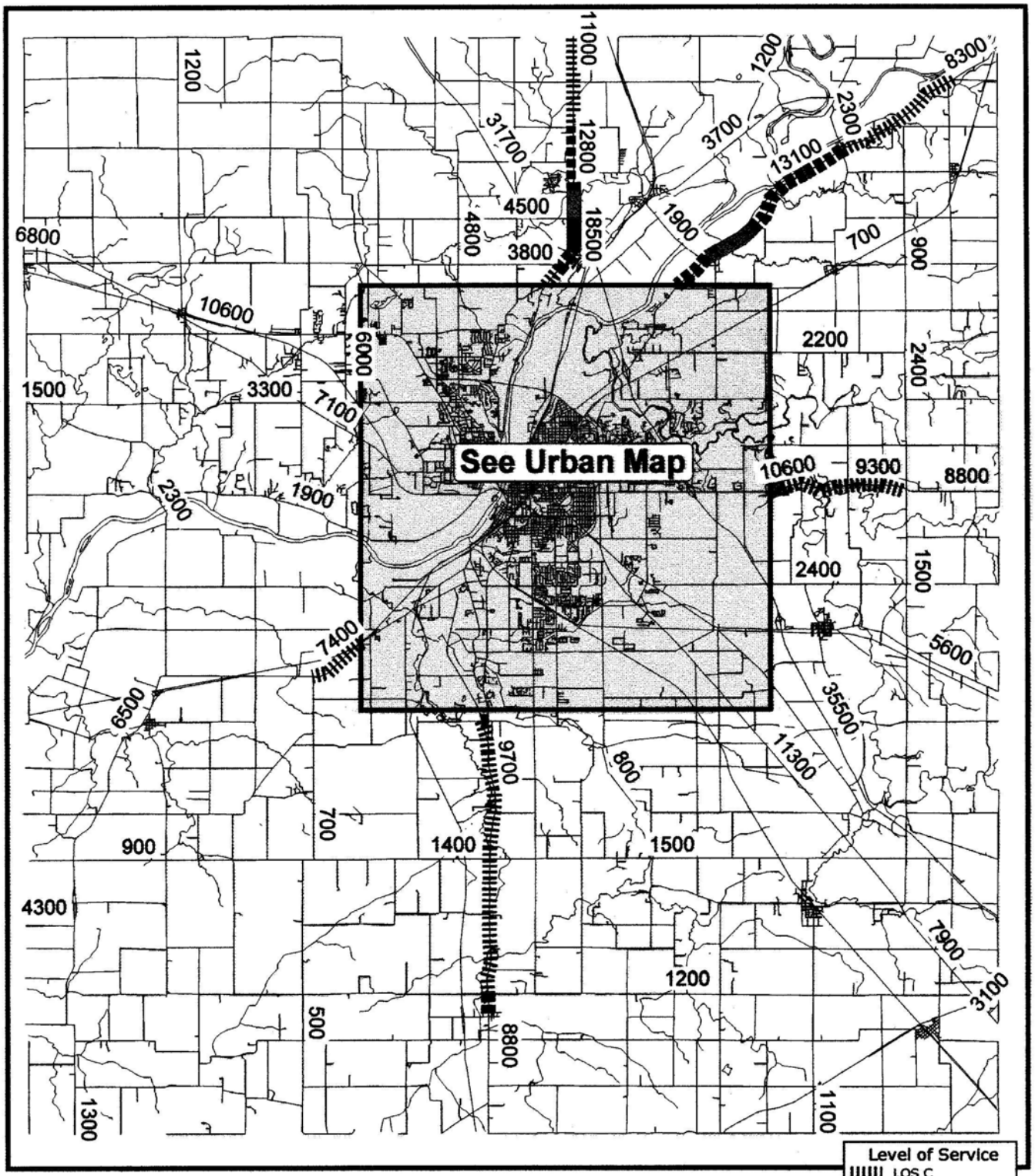
1999 Existing Road Network - Urban



Area Plan Commission of Tippecanoe County

Figure 3

1999 Existing Road Network - Rural



Area Plan Commission of Tippecanoe County

US 231, Teal Road, South 9th, Earl Avenue, and Union show up as LOS E. LOS D is even more common, and there are lots of segments already operating at LOS C. (For readability, we have left LOS A and B off in all graphics.)

Table 4 serves as a guide to our current and anticipated traffic problems, and as a way to compare proposed solutions. Here we show the number of miles of roads operating at LOS D through F currently, and as projected for various 2010 and 2025 alternatives by the model. Our current situation shows up in the column headed "1999 Base Year". The bottom row shows network-wide totals of LOS D-F mileage. We will refer to **Table 4** frequently throughout the rest of this chapter.

As of 1999, we already had 22.2 miles of roads operating beyond the acceptable design standard we call LOS C: 16.8 miles of LOS D; 4.1 miles of E; and 1.3 miles of F. Our problems are occurring on our biggest and busiest streets, our primary arterials. The numbers certainly corroborate our real-world experience.

But notice the next two column totals, the ones for our two No-Build scenarios. If we were to grow in population and jobs as expected, but build no new roads, and widen no existing roads, our total of LOS D-F miles would nearly triple in 10 years. Even if we build all of the projects currently planned but none after 2010, the miles of LOS D-F continue to increase. No-Build scenarios for 2010 and 2025 project 62.7 and 79.9 miles of LOS D-F respectively, with 15.2 and 30.6 of those miles at LOS F alone.

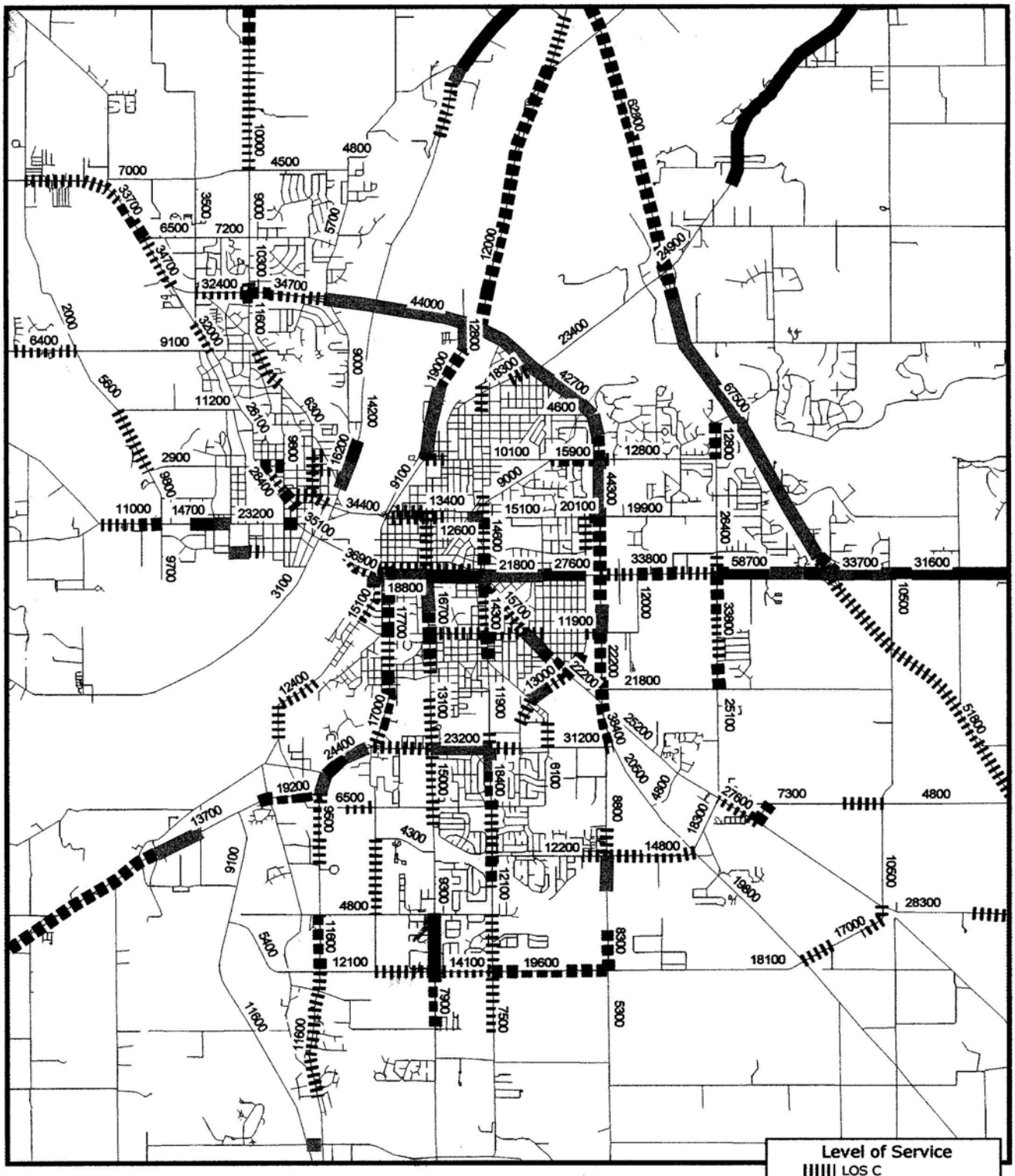
The locations of all this projected congestion can be seen in **Figures 4 and 5**. In 2010, the network breaks down along stretches of I-65, Sagamore

Table 4
Miles of Level of Service
1999 – 2025

Level of Service	1999 Base Year	2010 No Build	2025 No Build	2010 E+C Alt.	2025 1st Alt.	2025 2nd Alt.	2025 Plan
F	1.3	15.2	30.6	8.1	5.1	5.6	2.1
E	4.1	24.5	26.7	12.0	21.7	9.5	9.2
D	16.8	23.0	22.6	16.1	25.6	26.0	22.6
Total	22.2	62.7	79.9	36.2	52.4	41.1	33.9

Figure 4

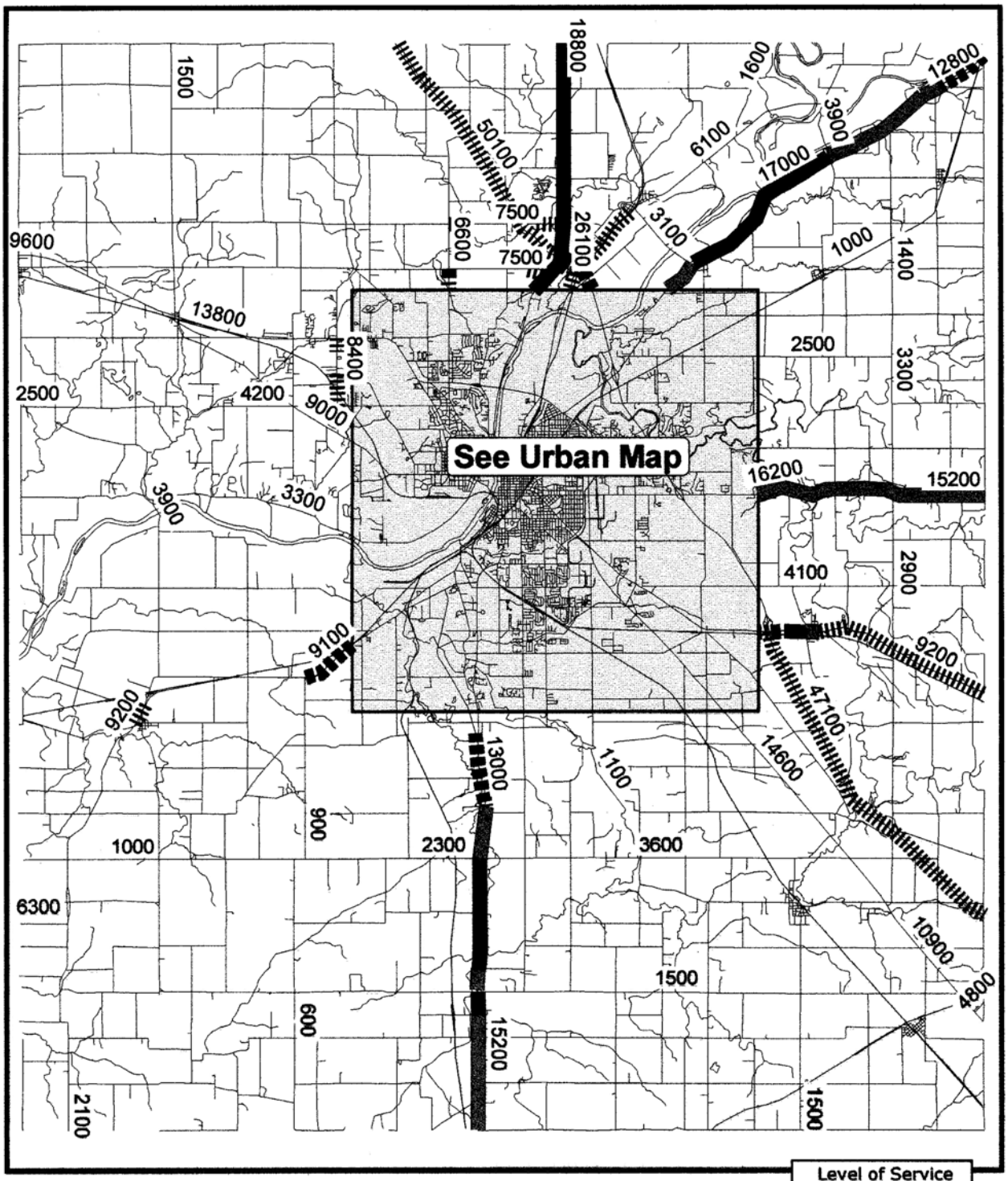
2010 No Build Network - Urban



Area Plan Commission of Tippecanoe County

Figure 4

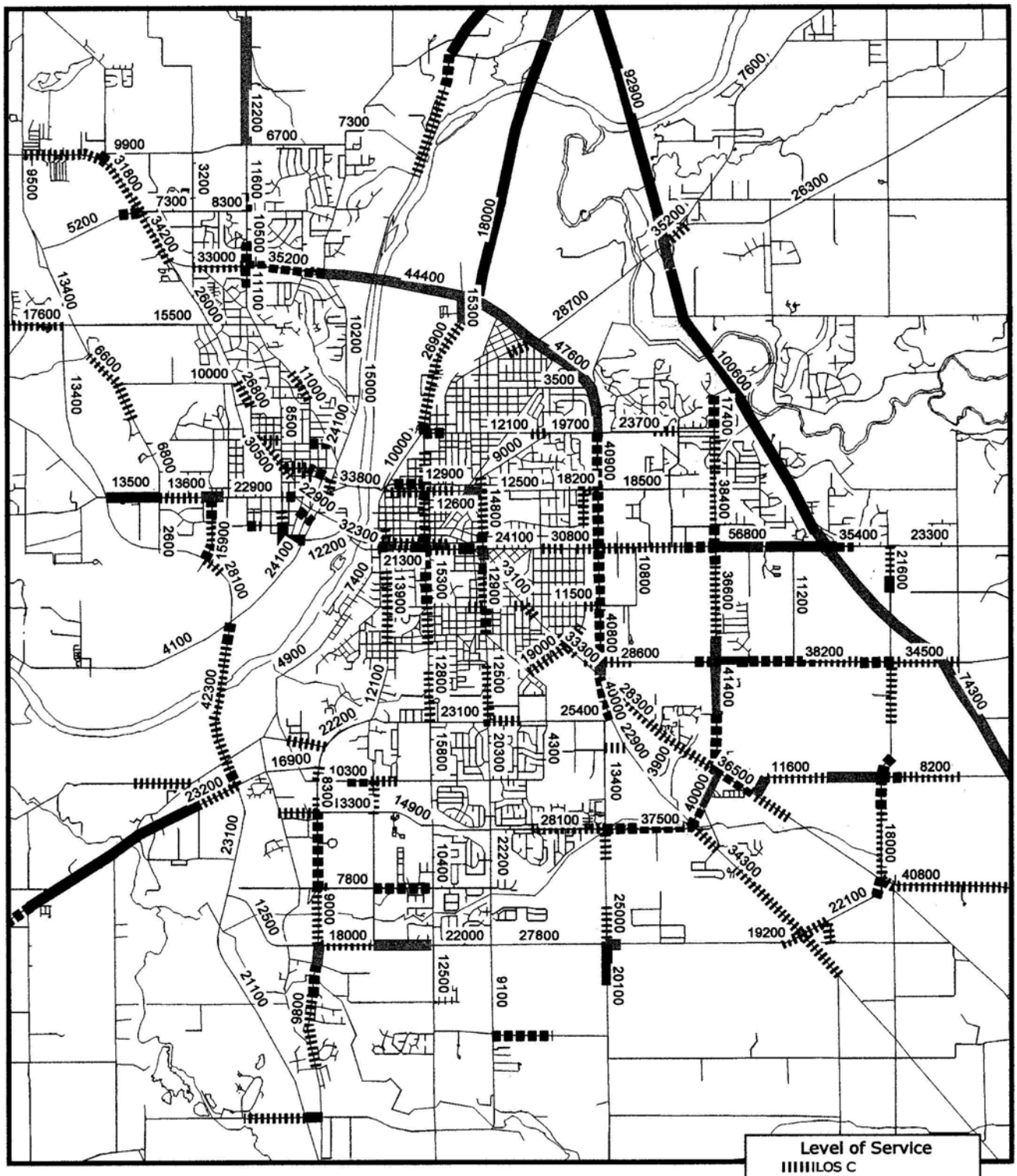
2010 No Build Network - Rural



Area Plan Commission of Tippecanoe County

Figure 5

2025 No Build Network - Urban

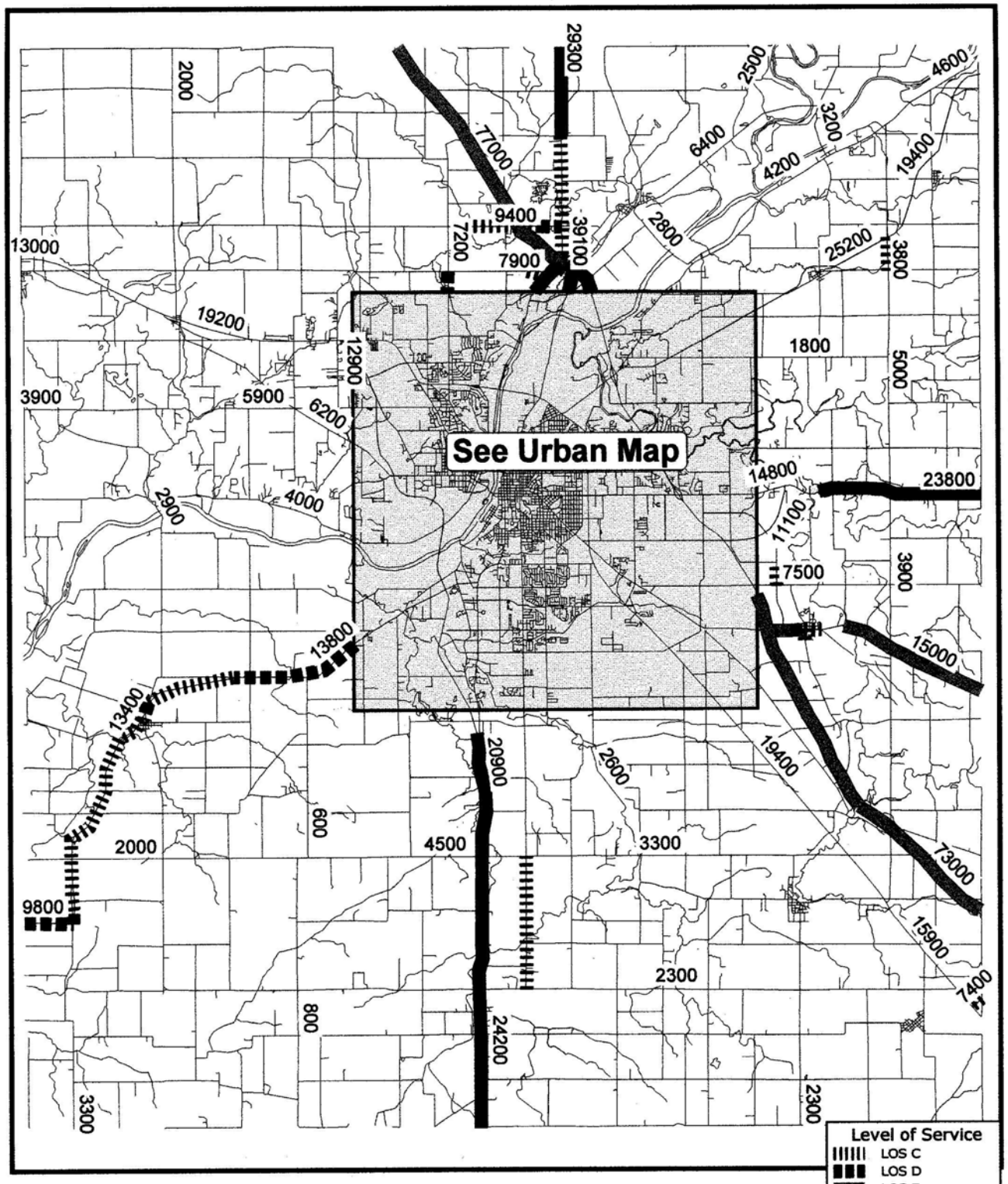


Area Plan Commission of Tippecanoe County

November 10, 2000

Figure 5

2025 No Build Network - Rural



Area Plan Commission of Tippecanoe County

November 10, 2000

Parkway, South Street, out SR 43 and 26, across Teal Road and up and down 4th, 9th, 18th Streets, on North 9th Street and North River Road. By 2025, the Interstate, along with portions of North 9th Street, South and State Street reaches gridlock. Commuters using SR 43, SR 26 to the east and US 231 to the south will experience heavy congestion. These then are worst-case scenarios, our do-nothing alternatives.

ACCOUNTING FOR COMMITTED PROJECTS

Barring major economic misfortune – a possible but unlikely circumstance – our worst-case traffic nightmares will not come true. Progress, at least through 2010, is already planned although not guaranteed. Some improvements are already under construction; others have had rights-of-way acquired or have at least undergone preliminary engineering studies. We anticipate still others that have been programmed in our Transportation Improvement Plan and the adopted Thoroughfare Plan, or are part of the State's Long-Range Plan. These are all facets of 1978 Transportation Plan implementation.

We call all these projects, added to our present system, the Existing Plus Committed (E+C) Network. For our planning purposes, we consider E+C to be our base for 2010, a springboard for additional improvements in the following decade and a half. Please refer to the section titled **"AN OVERVIEW"** in **Chapter 2** of this report and its **Figure 1**, for a full description of 2010 E+C.

But how well off will we be, from a traffic congestion point of view, if all these anticipated improvements are made by 2010? The answer comes as no surprise, we will be better if we build these improvements. Subjecting

the 2010 E+C network to the model shows us that we can expect fewer miles of LOS D-F if these projects are built. **Table 4** shows us a network total of 36.2 miles of LOS D-F for the E+C network, compared to 62.7 for the No Build. That difference is rather significant, especially when comparing the miles of LOS F and E. Both are almost reduced by half.

Figure 6 shows projected LOS and traffic volumes for our 2010 E+C Alternative. The worst problems seemed to be confined to SR 26 between Creasy Lane and the Interstate, SR 26 between relocated US 231 and Airport Road, portions of South and Columbia in downtown Lafayette, and the commuter routes to the north, east, and south. Notice with the improvements, congestion along Sagamore Parkway, SR 26, North 9th Street, Teal Road, and County Road CR 350S are completely eliminated.

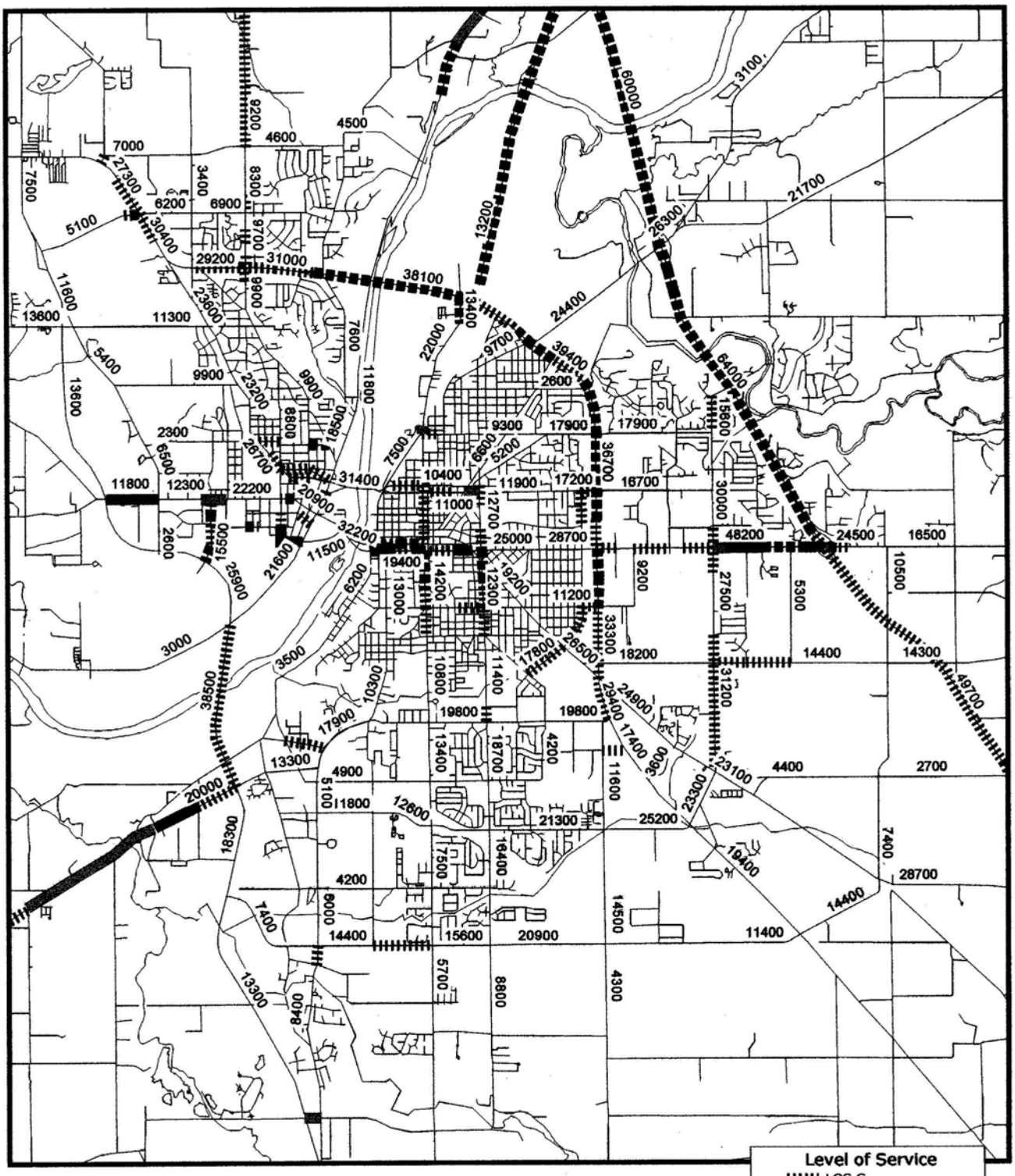
Despite these expected improvements in the network, the implication remains clear. As we continue to grow, we must keep pace with network improvements to solve some of our traffic congestion problems. Compare 2010 E+C and 1999 (**Figure 3**) regarding I-65, SR 43 north of SR 225, SR 26 east of the Wildcat Creek, US 231 south of CR 500S, and SR 26 between Creasy Lane and the Interstate.

SOLVING PROBLEMS BEYOND 2010

The projected 2025 No Build network found us losing ground on traffic congestion, rather than gaining. By testing the 2025 No Build network, what we did gain was knowledge. We became aware of problems still likely to continue to grow past 2010. Armed with this information, we began to test a series of alternative networks, each with a set of proposed projects

Figure 6

2010 E Plus C Alternative Network - Urban

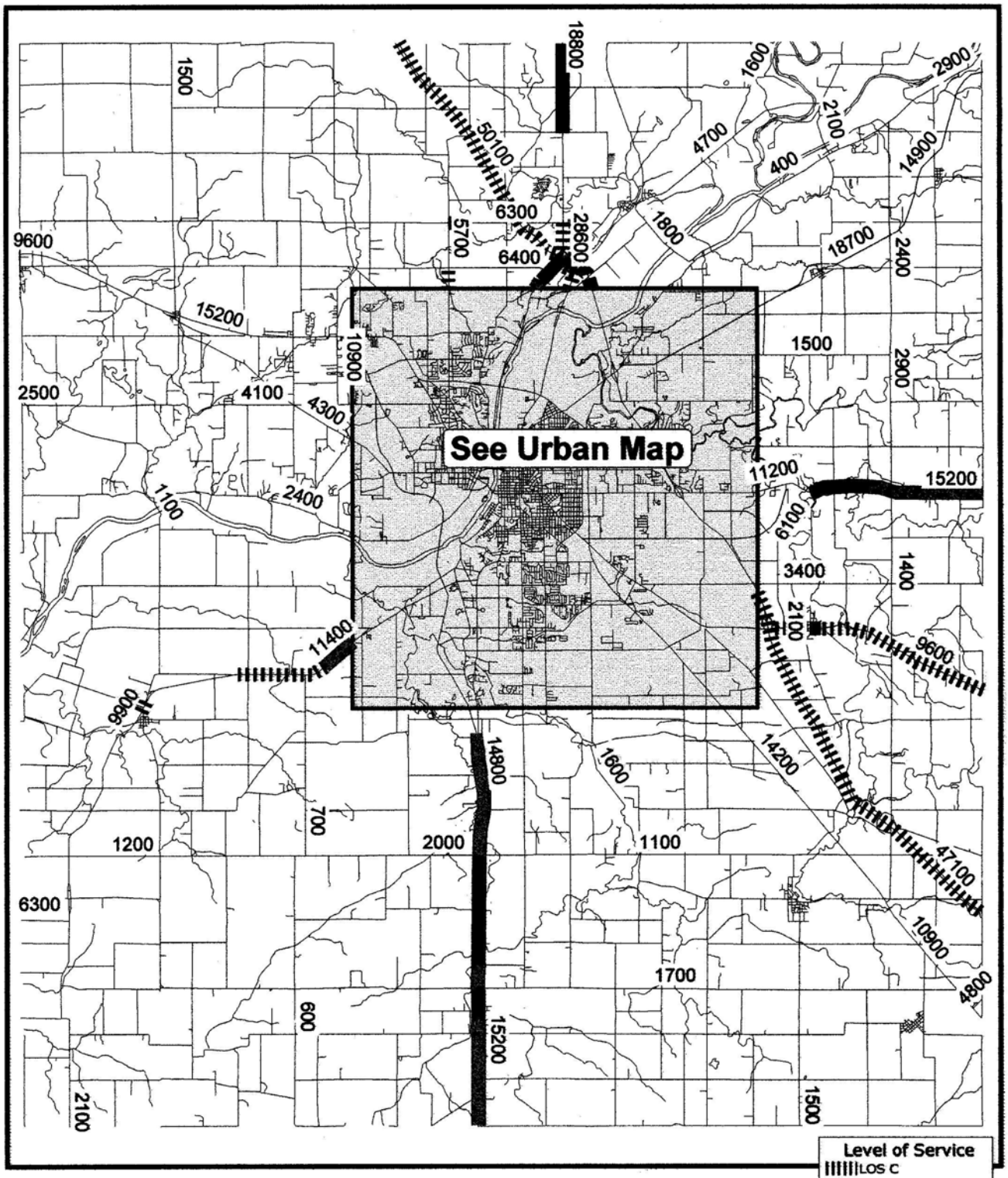


Area Plan Commission of Tippecanoe County

March 2, 2001

Figure 6

2010 E Plus C Alternative Network - Rural



Area Plan Commission of Tippecanoe County

March 2, 2001

intended to solve the traffic problems of 2025. These alternative solutions can be compared to the 2025 No Build Network.

Table 5 shows the features of all three 2025 alternative networks we subjected to the traffic forecast modeling process. They all assume 2010 E+C as a base. Alternatives 1 and 2 were developed from suggestions provided by the Technical Transportation, Administrative, and Citizens Participation Committees, the general public, plus some of our own. The third alternative, which we called the **2025 Transportation Plan**, combines the most effective features of the other two networks plus additional comments generated through the public participation process.

Alternative 1 (**Figure 7**) continues the relocation of US 231 northward past US 52 to the Interstate. Where the two meet, a new interchange would be built. This completes a circular loop or by-pass around Lafayette and West Lafayette via US 231, CR 350S, CR 475E/CR500E and I-65. Similar in design to the portions already built, it would be a four lane, divided, limited access road. Construction would not stop at the new interchange. Extending eastward, a new road would connect the Interstate to SR 43.

Currently INDOT is searching for an alternate route for SR 25 on Teal Road. Alternative 1 looks at possibly using CR 800S. Beginning at a new I-65 interchange, CR 800S would be widened as a super two lane road westward to US 231. State Road 25 would then be routed up US 231 to its existing location just south of the Wabash River.

Addressing the continual increase in traffic, Alternative 1 includes widening the Interstate from SR 43 to SR 38 from four to six lanes. This section,

Table 5 Comparison of Features in 2025 Alternative Network Tested			
Feature	ALT. 1	ALT. 2	PLAN
Super Two Lane Widening			
CR 800S: US 231 to I-65 (with interchange)	*		
CR 800S: US 231 to US 52		*	
CR 800S: SR 25 to US 231		*	
Widen Two to Four Lanes			
SR 25: CR 375W to New US 231	*		*
SR 26: New US 231 to Airport Road	*	*	*
SR 26: Airport Road to Intramural		*	*
SR 26: Wildcat Creek to County Line	*	*	*
SR 43: CR 725N to County Line	*	*	*
SR 43: Park Road to I-65	*	*	*
US 231: via Jackson Hwy & SR 26		*	
US 231: CR 500S to County Line	*	*	*
US 231: SR 25 (S. Int.) to Beck Lane	*	*	*
North 9th: Swisher Road to US 52	*	*	*
9th: Central Street to Teal Road		*	*
18th: CR 430S to Wea School Road		*	*
Beck Lane: Old US 231 to CR 50E	*	*	*
Concord Road: CR 350S to CR 500S		*	*
CR 350S: CR 50E to South 9th Street	*	*	*
CR 500S: New US 231 to Old US 231	*	*	*
Klondike Road: Lindberg Road to SR 26		*	
Widen Four to Six Lanes			
SR 26: US 52 to I-65	*	*	*
I-65: SR 43 to SR 38	*	*	*
I-65: County Line to SR 43		*	*
I-65: SR 38 to County Line		*	*
New Roads and Segments			
US 231: US 52 to I-65 (with interchange)	*		*
SR 43B: I-65 to SR 43	*		*
Cherry Lane: New US 231 to McCormick	*		*
Cumberland: Klondike Road to New US 231	*	*	*
CR 375S: Dayton Road to SR 38	*		
CR 500S: Wea School Road to US 52	*	*	*
Collector North: Creasy Lane to Park East	*	*	*
Collector South: Creasy Lane to Park East	*	*	*

Table 5 Continued Comparison of Features in 2025 Alternative Network Tested			
Feature	ALT. 1	ALT. 2	PLAN
New Roads and Segments Continued			
Duncan Road: US 52 to North 9th	*	*	*
Farabee Drive: Kossuth St. to McCarty Lane	*	*	*
New Castle & CR375S: CR 350S to Dayton Road	*	*	*
Park East Boulevard: McCarty to US 52	*	*	*
Other Improvements			
Modified Interchange at SR 26 & US 52		*	*

especially between SR 43 and SR 26, has become an alternative for local traffic. The model clearly shows this continuing in the future. Another widening to six lanes is proposed for SR 26 between US 52 and the Interstate.

Several new connecting roads would be constructed around the County. To the south, CR 500S would either be improved or new sections constructed between Wea School Road and US 52. This would provided another east-west connection, south of CR 350S and north of CR 800S. New Castle Road and CR 375S would be upgraded between CR 350S and Dayton Road and a new road built over to SR 38. Closer to town, developers would construct Park East Boulevard southward to SR 38 and US 52. Other connections would include Cherry Lane, Cumberland Avenue, and Farabee Drive.

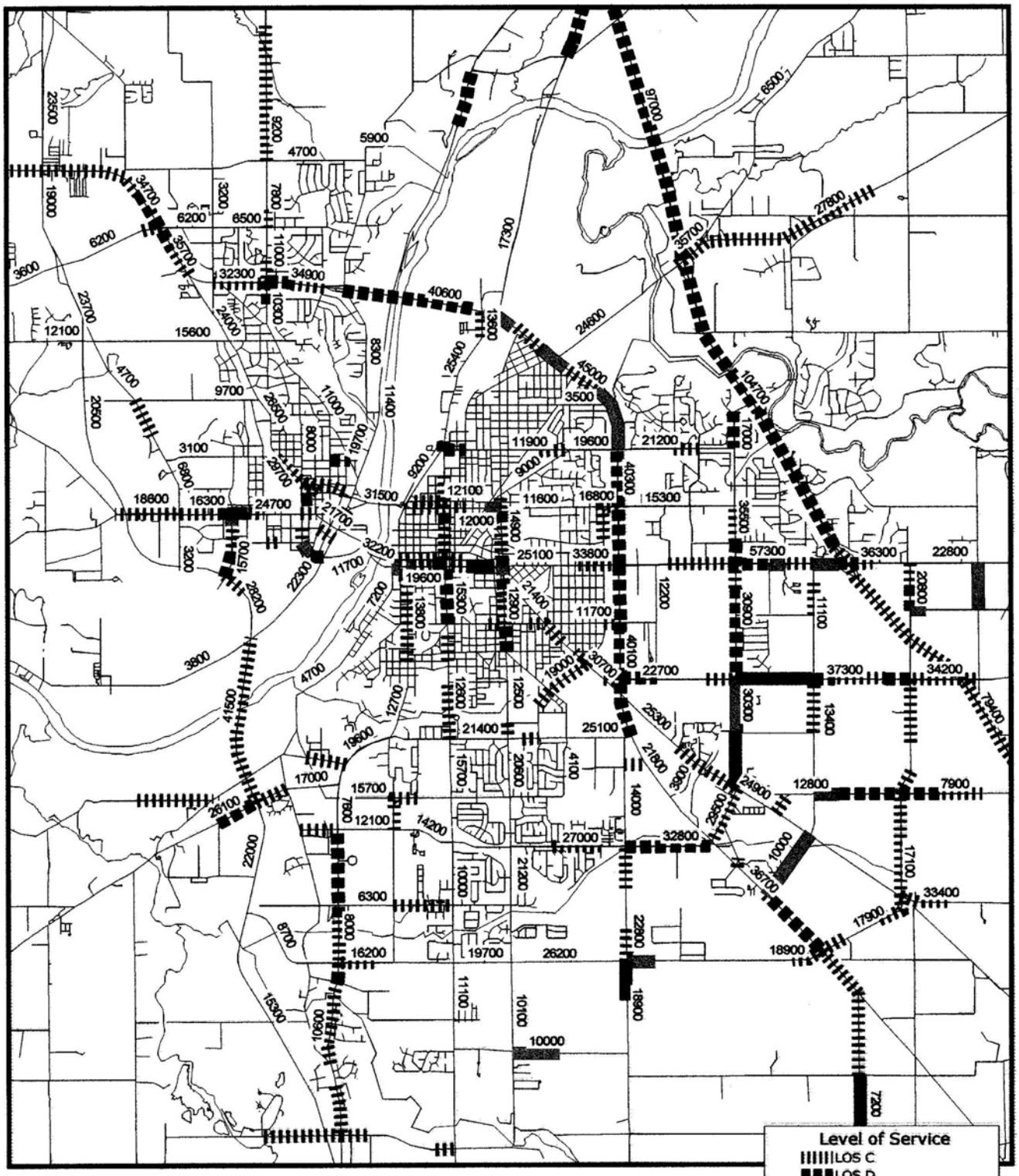
Major arterials that would also be widened include portions of SR 25, CR 350S, Old US 231 and Beck Lane. Alternative 1 also includes two projects located near the new State Park: widening SR 43 north to the Interstate and North 9th Street south to US 52. In rural Tippecanoe County, SR 43 northward, SR 26 eastward, and US 231 southward would be widened to meet the demand in commuter traffic.

How well does all this work? **Table 4** show us that Alternative 1 would be a significant improvement over 2025 No Build. A network total of LOS D-F for 2025 Alt 1 of 52.4 miles would be much better than 2025 No Build's 79.9 miles. The most dramatic difference is the miles of LOS F. It drops from 30.6 miles to 5.1. Unfortunately, even with all of these improvements, it does not get us back to the 2010 E+C level.

Projected LOS levels and traffic volumes for 2025 Alternative 1 are shown in **Figure 7**. Compare these to 2010 No Build (**Figure 4**). Notice how effective the construction of US 231 to I-65 and to SR 43 would be in alleviating congestion on SR 43, CR 600N, and County Farm Road. It also reduces traffic volume on Soldiers Home Road and North River Road. Widening SR 43 north and North 9th south of the new Prophetstown State Park road both reduce congestion from LOS F to a more acceptable level. While congestion is reduced on the Interstate between SR 43 and SR 38, it continues to be a problem both north and south of these State Roads. The extension of CR 375S east of Dayton Road to SR 38 fails to draw any traffic away on SR 38 through the Town of Dayton. Further south, the new SR 25 interchange attracts very little traffic off of the Interstate. It does create another alternate route to US 231 into Lafayette via CR 800S to CR 450E. Congestion on CR 450E reaches LOS F in one location. West of the Purdue Campus, widening SR 26 between Airport Road and relocated US 231 reduces LOS to C. However improvements are needed to the east along the south of Campus edge with congestion still occurring near Intramural Drive.

Figure 7

2025 Build Network, 1st Alternative - Urban

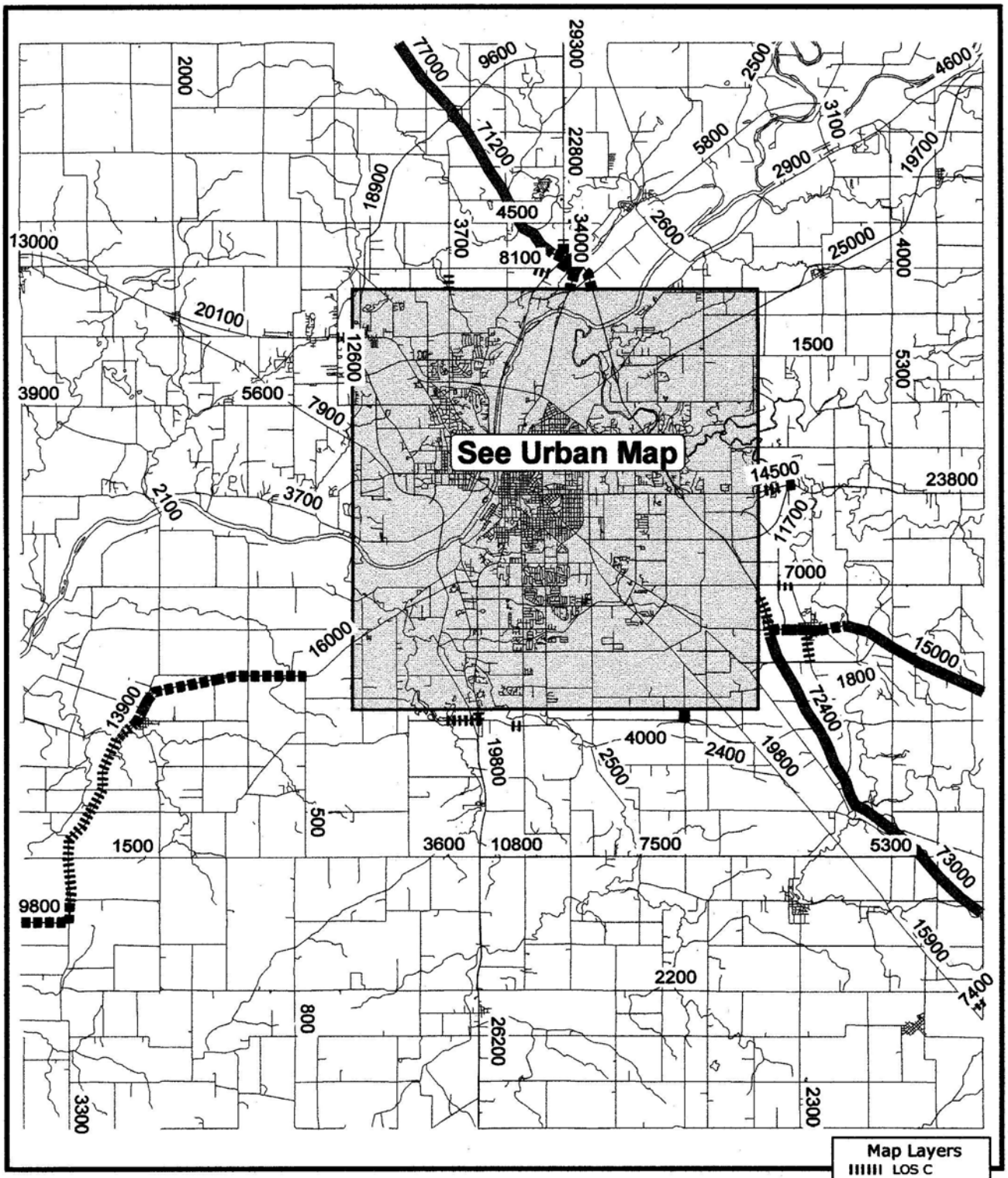


Area Plan Commission of Tippecanoe County

November 9, 2000

Figure 7

2025 Build Network, 1st Alternative - Rural



Area Plan Commission of Tippecanoe County

November 9, 2000

As **Table 5** shows, Alternative 2 for 2025 shares many of Alternatives 1's features while adding some new ones. One of the major differences is the routing of US 231 north of SR 26. Instead of taking a northerly direction and connecting to the Interstate, relocated US 231 would take a more westerly route. The route would follow SR 26 to Jackson Highway. At that point it would then use Jackson Highway until it reached the town of Montmorenci. A by-pass would be built around the town northward, eventually connecting back to existing US 231. Similar in design to the other proposed route, it would be constructed as a four lane, median divided, limited access road. In conjunction with this route, Klondike Road south of CR 200N to SR 26 would be widened to four lanes.

Based on suggestions, Alternative 2 revisits the proposed routing of SR 25 via CR 800S. In this set-up, the interchange is no longer included. SR 25 would be routed south along US 52 rather than I-65. Once again CR 800S would be improved to US 231. But instead of diverting the route on US 231, the improvements would continue westward on CR 800S to existing SR 25. Since this would become the new route, we looked to see if old SR 25 would not need to be widened west of relocated US 231.

Other major improvements were looked at. One was a modified interchange at Sagamore Parkway and South Street. While through and right-turning vehicles would continue using the existing intersection, all left turning vehicles would be directed to a secondary elevated intersection. Additional widening was tested. The Interstate would be widened to six lanes throughout the County. Concord Road, 18th Street, 9th Street, and State Street west of Airport Road would all be widened to four lanes. Finally, since the extension of CR 375S did not relieve congestion through Dayton, we removed the improvements between Dayton Road and SR 38.

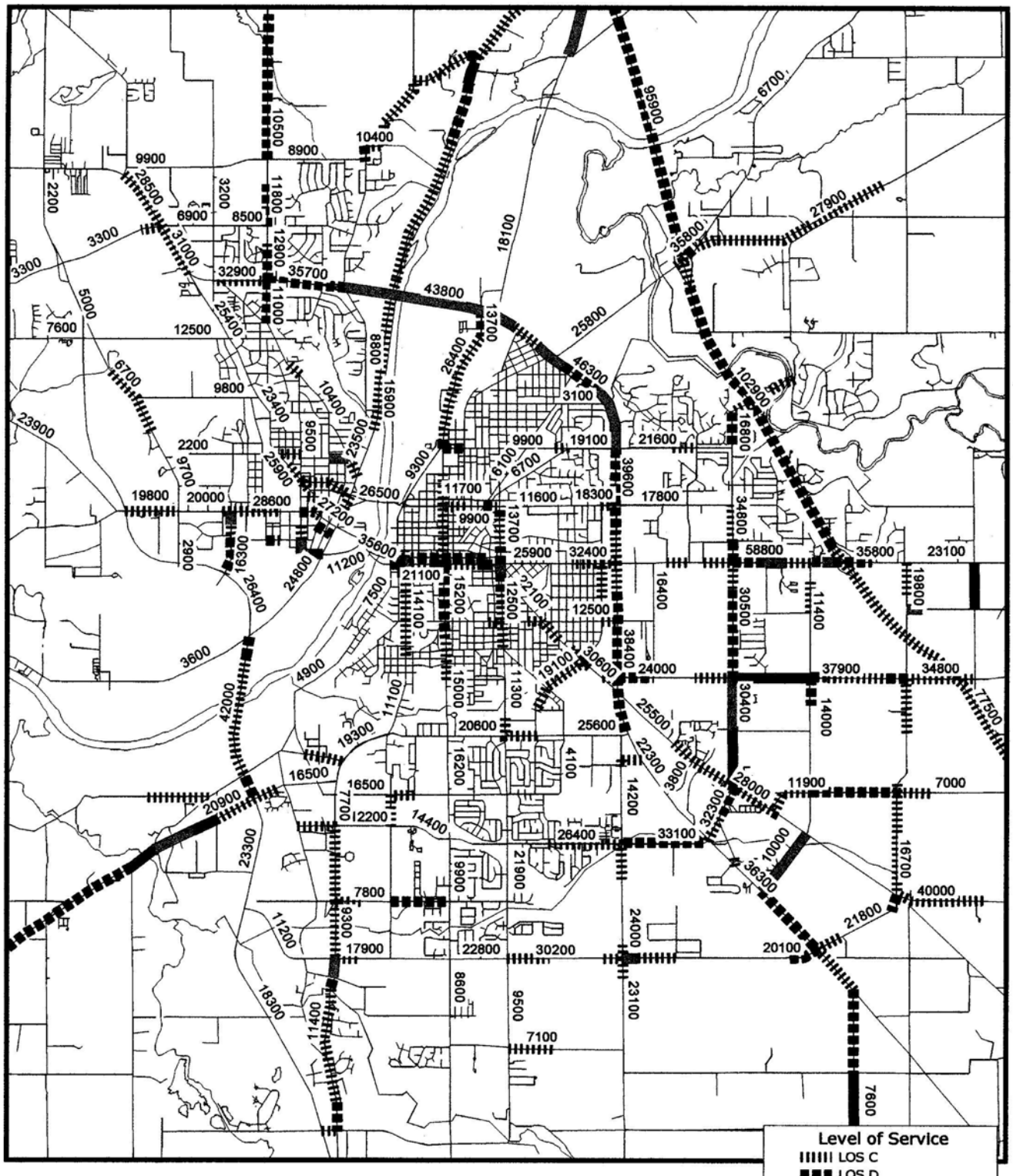
Alternative 2 proved to work somewhat better when tested with the traffic forecasting model. **Table 4** shows just 41.1 miles of LOS D-F. Compared to Alternative 1, that's more than ten fewer miles of congestion. However on a closer look, the miles of LOS F and D slightly increased. Simply put, some of the improvements worked and some did not. Alternative 2 projected LOS and traffic volumes are shown in **Figure 8**.

Finally, we created the Plan Network for 2025. It was assembled from the best features of Alternatives 1 and 2. The features are, again, summarized in **Table 5**. The routing of US 231 via SR 26 and Jackson Highway was dropped in favor of the northerly route. The SR 26 route split traffic between the new route and US 52. Thus both roads would be underutilized. However the most apparent impacts were on the north-south roads north of West Lafayette. SR 43 north of the Interstate surpasses 40,000 vehicles a day. Once again the road is over capacity even with the improvements done earlier in the Plan. Traffic volume increases on North River Road, CR 600N, County Farm Road, Kalberer Road, Cumberland Avenue, and Soldiers Home Road. As a direct result, congestion increases too.

The 2025 Plan abandons rerouting SR 25 along CR 800S. The cost of building two interchanges at CR 800S and US 231 in Tippecanoe County would be enormous especially considering the limited impact the southern interchange would have. Another reason is mileage between the SR 25 and I-65 Interchange to the SR 25 and CR 800S intersection. It is shorter to travel up I-65 to the new interchange and use relocated US 231 rather than traveling south on I-65 to a new southerly interchange and use CR 800S. By using relocated US 231, INDOT would save precious federal and state funds by not widening CR 800S and building a new interchange.

Figure 8

2025 Build Network, 2nd Alternative - Urban

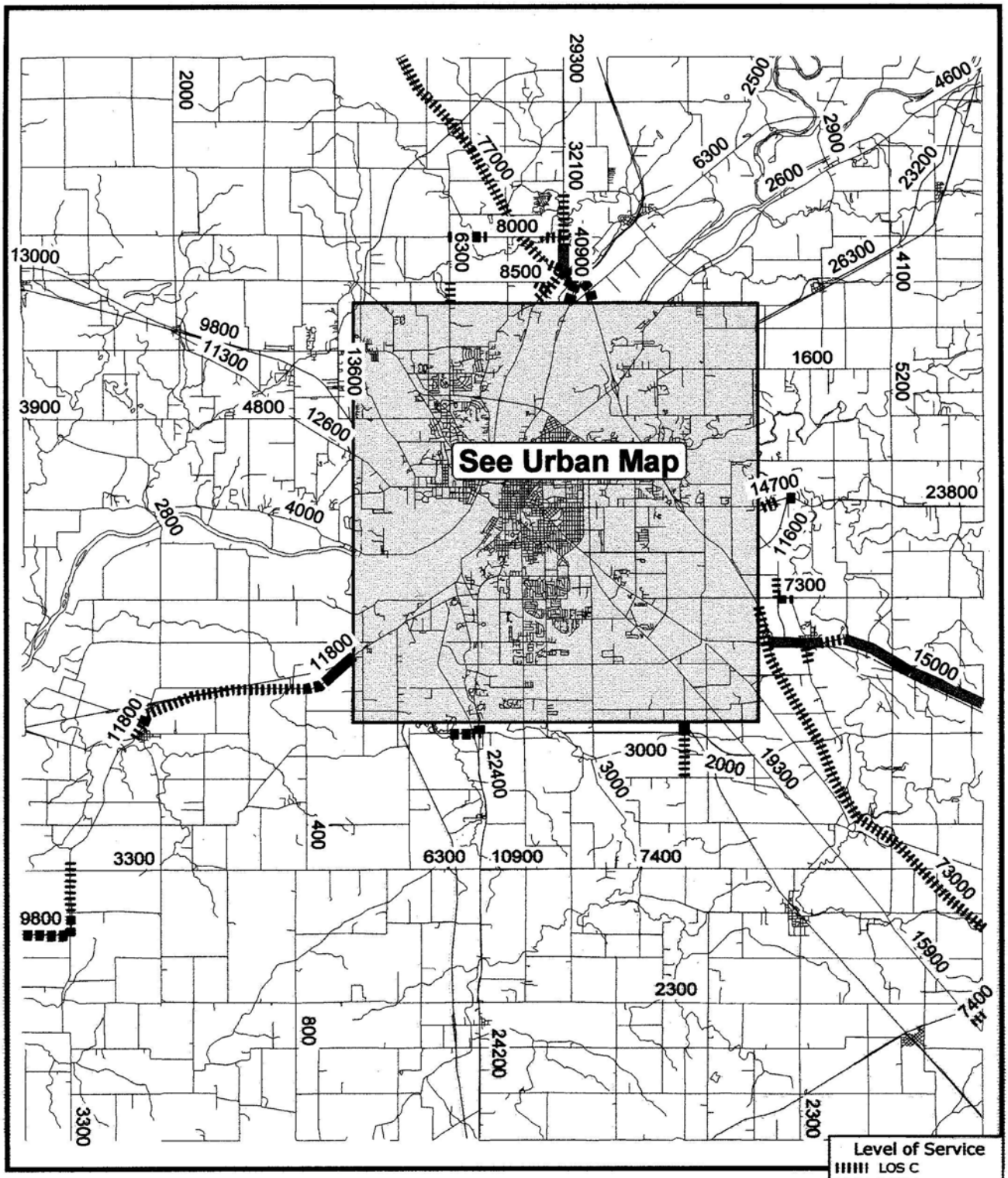


Area Plan Commission of Tippecanoe County

January 11, 2001

Figure 8

2025 Build Network, 2nd Alternative - Rural



Area Plan Commission of Tippecanoe County

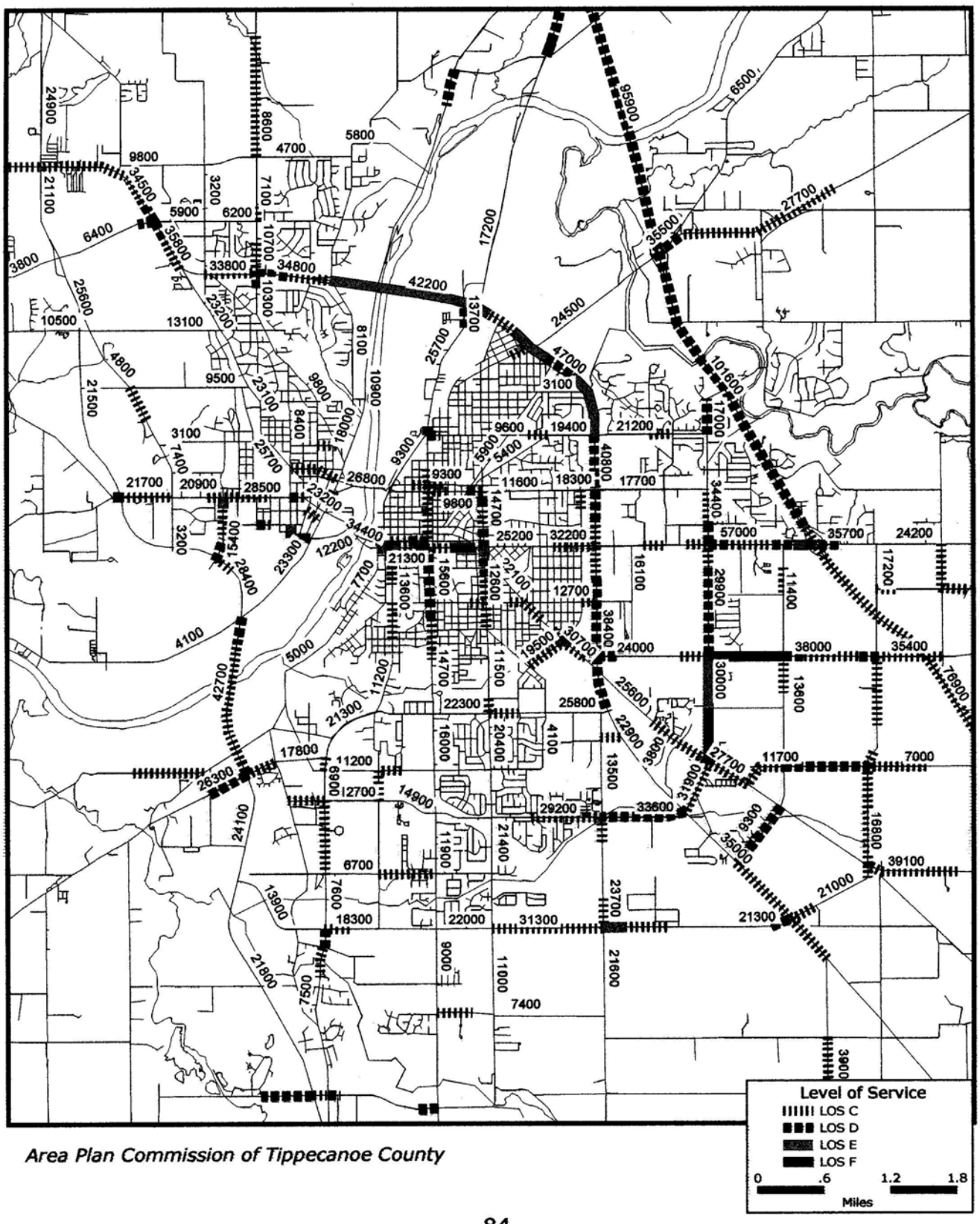
January 11, 2001

Figure 9 shows traffic volumes and LOS for this final version. Notice there remains just a handful of congested urban and rural road segments. Access via Harrison Street to the southeastern portions of campus remains problematic. Several congested areas continue to plague the downtown Lafayette corridors. In rural Tippecanoe County, SR 38 as well as portions of SR 25 are reaching capacity.

In summary, the **2025 Transportation Plan** presents us with many fewer miles of traffic congestion, is a clear indication of its effectiveness. We expect to grow by 46,000 people, add 19,000 dwelling units and 34,000 jobs, and still reduce our traffic congestion problems. The 2025 Plan betters the 2025 No Build by more than 57%. It even shows 6% fewer miles of congestion when compared to the 2010 E+C.

Figure 9

2025 Transportation Plan - Urban

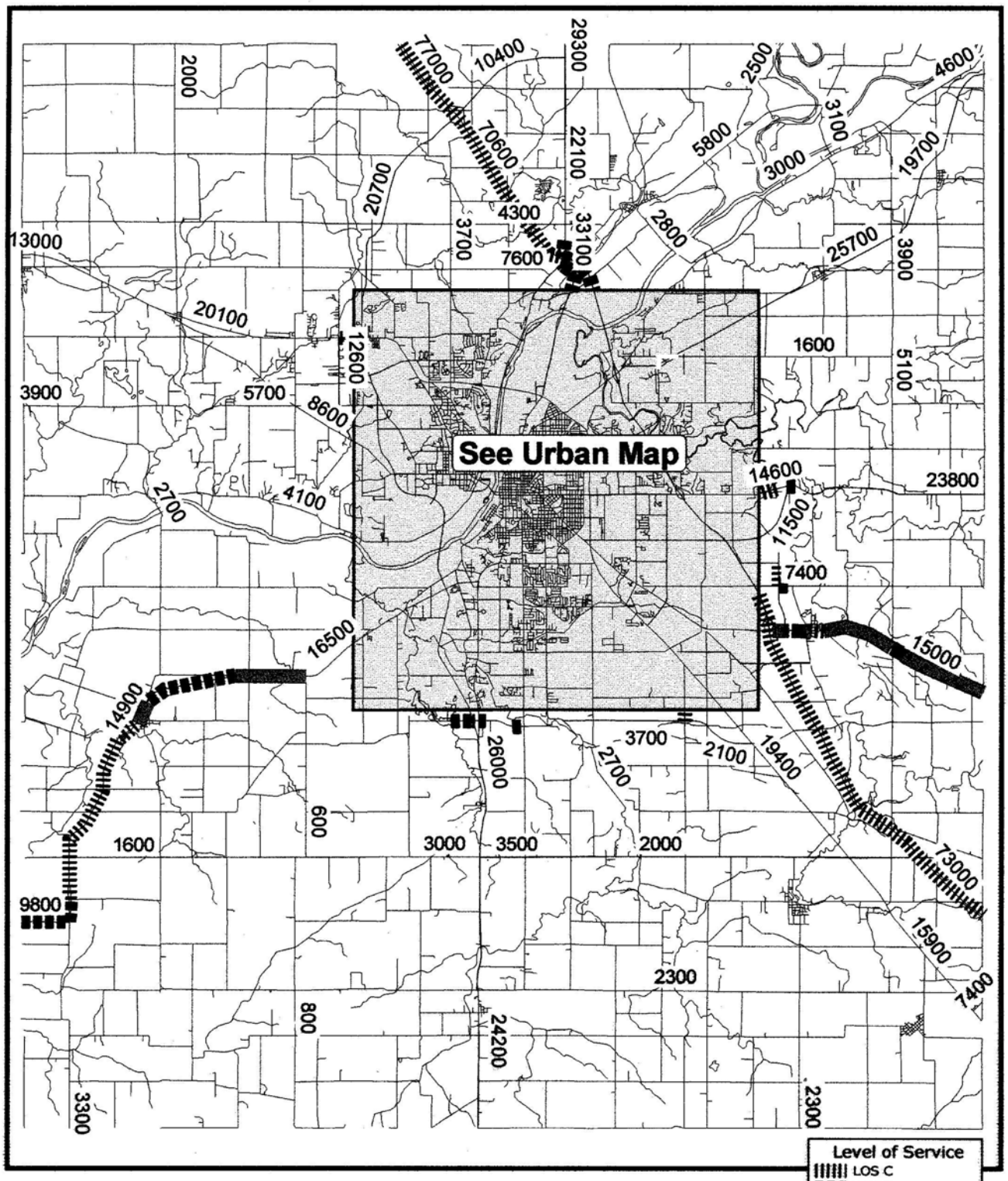


Area Plan Commission of Tippecanoe County

March 1, 2001

Figure 9

2025 Transportation Plan - Rural



Area Plan Commission of Tippecanoe County

March 1, 2001